

ADAPTIVE CHANNEL EQUALIZATION BY USING MEAN SQUARE ERROR

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Abstract:

This paper deals with the study of various kinds of interferences in a communication system viz inter symbol interference, co-channel interference and adjacent channel interference during the transmission of signal from the transmitter and received by the receiver in space. We are using the adaptive equalization method in channel equalization to mitigate these interferences by the use of mean square error method and analyze the results through MATLAB.

Keywords:

ISI, MSE, CCI, SNR and BER

1. Introduction:

Wireless communication [1] refers the transfer of information between two or more points that are not connected by an electrical conductor. In our daily life most common wireless technologies use is radio. The distance of the radio waves can be short, such as a few meters range for television or as far as thousands or even millions of kilometers for deep-space radio communications under the sea or in space through satellite. It includes garage door openers, wireless computer mice, keyboards and headsets, headphones, radio receivers, GPS Units, satellite television, broadcast television and cordless telephones. In the wireless communication all the data transferred wirelessly in the form of bits. Adaptive Channel Equalization comes under the category of wireless communication. When the signal is passes from the source it's not fully received by the receiver, there are more factors that distorted the signal whether it in satellite or mobile phones and broadcast television information's. These all factors could be avoided by using different techniques that includes different types of equalizers and mean square error method.

2. Channel Equalization:

Channel Equalization is the process that is used to adjusting the unequal frequency response means response on different frequencies in a system. It is used to mitigate the effect of viz inter symbol interference, co-channel interference and adjacent channel interference occurred in the signal from input to the output. Sound recording and reproduction, electronics and telecommunications are the major fields that use channel equalization methods. Equalization compensates for the differences in the signal attenuation and the delays associated with different frequency response. The problems that occurred during the transmission of signal are:

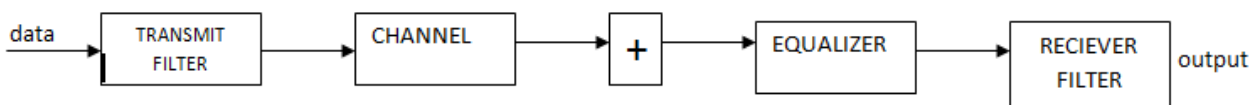
1. ISI: ISI refers to inter symbol interference [2], is the form of distortion in which one symbol interface with subsequent symbols and produced the side lobes in the signal. It causes too much error distortion at decision making device. ISI arises when the data is transmitted through the channel is dispersive in which each received pulse is affected by the adjacent pulses due to which the interference occurs in the transmitted signals. It means that there should be no interaction between the two symbols. If there is ISI then spike is scattered for the each path in the channel.

2. Co-channel interference and Adjacent Channel Interference [3]: These interferences are occurred in the communication systems due to the multiple access techniques that using time, frequency and space. CCI occurs in the cellular radio and dual polarized microwave radio for efficient utilization of the allocated channel frequencies by receiving the frequency in the different cells. Channel Equalization is done by EQUALIZER.

3. Equalizer: Equalizer is the filter use for the compensation of unequal frequency response. EQ allows the users to adjust the one or more parameters and determine the overall shape of the full transfer function. It is used to improve the nature of the sound remove the noise that is fully undesirable. The main objective of the EQ is to mitigate the effects i.e. interferences and build a system that is delayed inverse of the transmission channel and removing ISI while simultaneously rejecting the additive interferences uncorrelated to the source.

1. Preset Equalizer: Those equalizers in which the frequency response characteristics are unknown but time invariant and the parameters of an equalizer are adjustable. If the parameters are once adjusted it will be fixed during the transmission of data it could not be changed.

2. Adaptive Equalizer [4]: Those equalizers that can update their parameters on a periodic basis during the transmission of data. An adaptive equalizer is an equalization filter that automatically adapts to time-varying properties of the communication channel. It can be implemented to perform tap-weight adjustments periodically or continuously. So we prefer adaptive equalizer then other.



3. Mean Square Error: Now in Adaptive Filter we are taking a MSE method to calculate and minimize the error from the channel. The MSE [5] of the estimator measures the average value of the square of the errors it means the difference between the estimator and the estimated values.

4. Analyze the MATLAB Steps: In the MATLAB [6] we are using two parts that is first training sequence part and then actual part. In this method first we have to take the length of the training sequence and the number of sequence to be transmitted for SNR. Taking the bits of the actual ISI that creates the interference in the signal. Calculate the SNR, variance and the square of variance so that we could find the error in the signal. After the training sequence to find the channel output, pass the actual ISI bits to the filter along with training sequence. After the channel output initialize the ISI for the equalization part so that we can calculate the estimates training sequence and the estimated channel output. The transmitted information sequence is also passed to the filter after then channel output gives the results. Plot the SNR results through implementing in a MATLAB. Fig 02 represents the block diagram of code that implemented in MATLAB.

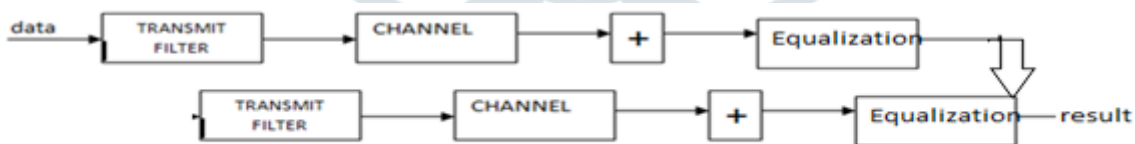


Fig 02 An overview in MATLAB

Output: Output 1 indicates the less error to the maximize number of bits. It uses the both training and actual part whereas Output 2 is only if we apply the training part.

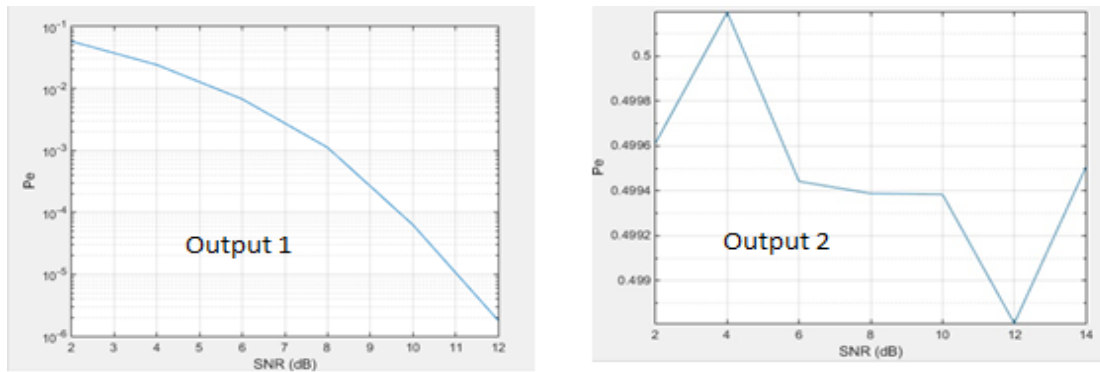


Fig 3 Graph between Probability error vs SNR

5. Conclusion:

This paper concludes about the minimizing of the error and mitigate the effects of the ISI and other interferences from the channel so that the signal that is transmitted would be received exactly same without any distortion form or any interferences. With the help of Adaptive Channel Equalizer we could mitigate the effects properly. MSE is one of the best methods that minimize the error by calculating the mean and the variance. MSE is equivalent to minimizing the variance, and the estimator that does this is the minimum variance unbiased estimator.

6. References:

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